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10/583,236	03/06/2007	Furong Zhu	34018-1040	8256

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EXAMINER
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SCHOOLMAN, BRIAN T

ART UNIT	PAPER NUMBER
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2879

MAIL DATE	DELIVERY MODE
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10/18/2007

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

Application No.

10/583,236

Applicant(s)

ZHU ET AL.

Examiner

Brian T. Schoolman

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 05 October 2007.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-19, 21, 23-25, 27 and 28 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-19, 21, 23-25, 27 and 28 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 16 June 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date 2/28/07; 7/16/07.
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- ☐ Notice of Informal Patent Application
- ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Response to Amendment***

The Amendment, filed on 10/5/07, has been entered and acknowledged by the Examiner.

Cancellation of claims 20, 22, and 26 has been entered.

Claims 1-19, 21, 23-25, 27 and 28 are pending in the instant application.

### ***Claim Objections***

1. Claims 2 and 3 are objected to because of the following informalities: the word "interfacifal" should read "interfacial". Appropriate correction is required.

2. Claims 7, 8, 13-19, 21, 23-25 and 27 are objected to because of the following informalities: Dependencies of the claims seem incorrect. As is, these claims fail to further limit their respective parent claims. For purposes of continued examination, the claims' dependencies will be considered as follows:

3. Claim 7 will be considered as dependent on claim 6.
4. Claim 8 will be considered as dependent on claim 5.
5. Claim 13 will be considered as dependent on claim 12.
6. Claim 14 will be considered as dependent on claim 13.
7. Claim 15 will be considered as dependent on claim 13.
8. Claim 16 will be considered as dependent on claim 13.
9. Claim 17 will be considered as dependent on claim 16.
10. Claim 18 will be considered as dependent on claim 17.
11. Claim 19 will be considered as dependent on claim 17.

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12. Claim 21 will be considered as dependent on claim 16.
13. Claim 23 will be considered as dependent on claim 13.
14. Claim 24 will be considered as dependent on claim 23.
15. Claim 25 will be considered as dependent on claim 24.
16. Claim 27 will be considered as dependent on claim 23.
17. Appropriate correction is required.

***Claim Rejections - 35 USC § 102***

18. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

19. Claims 1-12 and 28 rejected under 35 U.S.C. 102(e) as being anticipated by Mishima (US 20030178937 A1).

1. Regarding claim 1. A flexible organic light emitting device (**abstract**) comprising: a flexible substrate (**paragraph 19**), a lower electrode layer on said flexible substrate (**paragraph 19**), an upper electrode layer that is at least semi-transparent (**paragraphs 19**), an organic region (**paragraph 19**) between said lower electrode layer and said upper electrode layer, in which electroluminescence can take place when a voltage is applied between said lower electrode layer and said upper electrode layer (**paragraph**

80), wherein said flexible substrate is comprised of one of the following: a plastic layer laminated to or coated with a metal layer, (ii) a metal layer sandwiched between two plastic layers, and (iii) a metal foil (**paragraph 23**); further wherein at least one of the lower electrode and the upper electrode is a metal electrode (**paragraphs 32-33**) having an interfacial modified surface for enhancing charge carrier injection wherein said interfacial modified surface is between said organic region and said metal electrode (**paragraphs 67 and 70**).

2. Regarding claim 2. The flexible organic light emitting device of claim 1, wherein said interfacial modified surface may be formed by modifying said metal electrode using a TCO. **Paragraph 70.**

3. Regarding claim 3. The flexible organic light emitting device of claim 1, wherein said interfacial modified surface may be formed by modifying said metal electrode using inorganic or organic materials. **Paragraph 70.**

4. Regarding claim 4. The flexible organic light emitting device of claim 1, wherein said flexible substrate is comprised of a plastic layer laminated to or coated with an aluminum layer, the plastic layer being positioned between the lower electrode layer and the aluminum layer. **Paragraphs 23 and 24.**

5. Regarding claim 5. The flexible organic light emitting device of claim 1, wherein said flexible substrate is comprised of a steel foil. **Paragraph 21.**

6. Regarding claim 6. The flexible organic light emitting device of claim 1 further comprising an isolation layer between said flexible substrate and said lower electrode layer. **Paragraph 12.**

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7. Regarding claim 7. The flexible organic light emitting device of claim 4, wherein said isolation layer is a spin-coated polymeric layer or a dielectric layer. **Paragraph 12.**

8. Regarding claim 8. The flexible organic light emitting device of claim 3 further comprising an isolation layer between said steel foil and said lower electrode layer.

**Paragraph 12.**

9. Regarding claim 9. The flexible organic light emitting device of claim 1, wherein said upper electrode layer is transparent. **Paragraph 19.**

10. Regarding claim 10. The flexible organic light emitting device of claim 1, wherein said upper electrode layer is a semitransparent or transparent anode. **Paragraph 19, 33, or 36.**

11. Regarding claim 11. The flexible organic light emitting device of claim 1, wherein said upper electrode layer is a semitransparent or transparent cathode. **Paragraph 19.**

12. Regarding claim 12. The flexible organic light emitting device of claim 1, wherein said upper electrode layer is a multilayer structure comprising at least one semitransparent or transparent conductive film. **Paragraph 67.**

13. Regarding claim 28. The flexible organic light emitting device of claim 1, wherein said organic region comprises a hole transporting layer and an emissive layer and/or an electron transporting layer. **Paragraph 41.**

***Claim Rejections - 35 USC § 103***

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

15. Claims 13, 15-19, 21, 23-25 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mishima (US 20030178937 A1).

16. Regarding claim 13. The flexible organic light emitting device of claim 10, wherein said multilayer structure comprises an index-matching layer and a charge carrier injection layer. **Mishima teaches the invention as claimed except for being silent to an index-matching layer. Paragraph 67 discusses some materials used in the multilayer structure, including the charge carrier injection layer. While not explicitly stated, it would have been obvious to call the metal layer an "index matching layer" as it would need to serve to effectively control the index of refraction in the device.**

17. Regarding claim 15. The flexible organic light emitting device of claim 11, wherein said index-matching layer comprises an inorganic material having a refractive index effective for enhancing light output. **Paragraphs 67-70 disclose inorganic materials used, and since the device is designed for providing light output, the materials used obviously have an effective refractive index.**

18. Regarding claim 16. The flexible organic light emitting device of claim 11, wherein said multilayer structure is an anode and said charge carrier injection layer is a hole injection layer. **Paragraph 58 describes an anode and hole injection layer structure.**

19. Regarding claim 17. The flexible organic light emitting device of claim 14, wherein said hole injection layer comprises a high work function metal or a transparent conductive oxide (TCO). **Paragraph 67 describes materials such as gold or silver.**

20. Regarding claim 18. The flexible organic light emitting device of claim 15, wherein said high work function metal is gold or silver. **Paragraph 67 describes materials such as gold or silver.**

21. Regarding claim 19. The flexible organic light emitting device of claim 15, wherein said TCO is metal oxide selected from the group consisting of indium-tin-oxide (ITO), zinc-indium-oxide, aluminum-doped zinc oxide, Ga-In-Sn-O, SnO<sub>2</sub>, Zn-In-Sn-O, and Ga-In-O. **Paragraph 70 teaches the use of various metal oxides.**

22. Regarding claim 21. The flexible organic light emitting device of claim 14, wherein said hole injection layer comprises an organic material effective for hole injection or an inorganic material effective for hole injection, or a combination of inorganic and organic materials that are effective for hole injection. **Paragraphs 67-70 disclose various materials used.**

23. Regarding claim 23. The flexible organic light emitting device of claim 11, wherein said multilayer structure is a cathode and said charge carrier injection layer is an electron injection layer. **Paragraphs 67-70.**

24. Regarding claim 24. The flexible organic light emitting device of claim 21, wherein said electron injection layer comprises a low work function metal. **Paragraph 67 teaches that the material can be of a work function of 4.5 eV or less, and materials can include rare earth metals. It would have been obvious to one skilled**



**in the art to combine these statements to come up with a low work function metal to use in the device.**

25. Regarding claim 25. The flexible organic light emitting device of claim 21, wherein said low work function metal is a rare earth metal and said index-matching layer comprises tris-(8-hydroxyquinoline) aluminum (Alq3) or N,N'-di(naphthalene-1-yl)-N,N'-diphenylbenzidine INPB). **Paragraph 3 teaches the use of an aluminum complex (Alq) and Paragraph 67 teaches the use of a rare earth metal.**

26.

27. Claims 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mishima (US 20030178937 A1) as applied to claim 13 above, further in view of Forrest et al (US 6972431 B2).

28. Regarding claim 14. The flexible organic light emitting device of claim 11, wherein said index-matching layer comprises an organic material having a refractive index effective for enhancing light output. **Mishima teaches the device as claimed except for having an organic material having a refractive index effective for enhancing light output. Forrest teaches in column 1, lines 40-45 that the indices of refraction of organic materials allow for efficient light coupling into devices, leading to potentially high quantum efficiencies. It would have been obvious to one skilled in the art to use an organic material as the index-matching layer as taught by Forrest et al with the device of Mishima in order to enhance the efficiency of the device.**

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29. Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mishima (US 20030178937 A1) in view of Berggren et al (US 5932965).

30. Regarding claim 27. The flexible organic light emitting device of claim 21, wherein said cathode comprises a silver layer (**Paragraph 67**) and said electron injection layer is comprised of a calcium sub-layer over a lithium fluoride sub-layer, the silver layer being formed over the calcium layer. **Mishima teaches the invention as claimed except for specifically stating that the electron injection layer is comprised of a calcium and lithium sub-layer structure. Berggren et al teaches that calcium can be used as it has a desirable work function (Berggren et al (US 5932965) column 4, lines 9-11). Mishima teaches that a lithium fluoride layer can be used in the forming of an electron injecting layer (paragraph 85). It would have been obvious to one skilled in the art to use a calcium sub-layer over a lithium fluoride sub-layer in order to obtain the advantages of the desired work function material as well as the ability for the materials to form an effective sealing layer (paragraph 78) to protect water and oxygen from entering or permeating into each layer of the device.**

### ***Conclusion***

31. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- US 5932965 A                      Berggren; Rolf Magnus et al.
- US 6963081 B2                    Gupta; Rahul et al.
- US 6687266 B1                    Ma; Bin et al.
- US 20030062830 A1              Guenther, Ewald et al.

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- US 7026758 B2      Guenther; Ewald et al.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian T. Schoolman whose telephone number is 571-272-9823. The examiner can normally be reached on 7:30AM-5PM EST First Friday Off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nimesh D. Patel can be reached on 571-272-2457. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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Art Unit 2879

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